On-Board Diagnostics II (OBD II) and Emission Warranty Regulatory Update

California Air Resources Board
Mobile Source Control Division

September 28, 2006
Sacramento, California

Today's Presentation

- Background
- Gasoline OBD
- Diesel OBD
- Other Items

Background

- OBD II originally adopted 1989
  - 1996 and newer vehicles
- Monitors virtually every emission-related component
  - Threshold
  - Functional
- Illuminates warning light and stores fault info for repair technicians
- Program updates occur regularly
  - Last revisions adopted April 2002

Reasons for Changes

- Keep pace with technology
- I/M and technician feedback and experience
- Certification staff experience
- Review previous round of adopted requirements

Where we are today

- 120+ million OBD II equipped cars in the U.S.
  - More than 50% of the in-use fleet
  - Over 6 trillion miles accumulated in-use
- 25 states in the U.S. using OBD II for I/M, including CA
  - Nearly 13,000 OBD II inspections a day just in CA

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Gasoline OBD II Overview

- Requirements very mature
- Systems largely performing as designed
- Minimal changes proposed
- Updates focus primarily on issues identified in-use

Rear Oxygen Sensor Monitoring

- Problem: Not detecting some deteriorated catalysts
- Cause: Inadequate rear O_2 sensor performance
- Fix: Improved monitoring of rear O_2 sensor
- Proposal: 2009-2011 phase-in

Cylinder A/F Imbalance

- Problem: Previously unconsidered failure mode with high emissions
- Cause: Cylinder to cylinder differences in air/fuel ratio
  - E.g., fuel injector variation
  - Improperly corrected by fuel control
- Fix: New monitor to specifically detect this fault using existing sensors
- Proposal: 2011-2014 phase-in

Cold Start Emissions

- Most emissions occur at cold start
  - Before catalyst is warmed-up
- “Cold start” strategies accelerate catalyst warm-up
- Monitoring currently required for failures that cause emissions to increase above a threshold

Cold Start Strategy Monitoring

- Problem: Some only monitor entire strategy—requiring multiple components to fail before a fault is detected
- Fix: Require separate functional monitoring of each commanded element
  - E.g., ignition retard
- Industry concern: Individual elements have small emission impact and cannot be monitored as stringently as proposed
- Staff Response: If any element is non-functional (e.g., no ignition retard), something obviously broken

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Diesel Overview

- For Medium-duty, diesels:
  - Majority of the fleet
  - Share engines with Heavy-Duty
  - Align with Heavy-Duty OBD requirements
- For Light-duty, diesels:
  - Currently <1% of fleet
  - Compete with gasoline engines
  - OBD requirements should be comparable
  - New emission controls need time for OBD development

Medium-Duty Threshold Monitors

- For 2010+, thresholds identical to heavy-duty
  - Interim levels in 2010, drop to final in 2013
- For 2007-2009, thresholds reflect currently available technology
- Examples of threshold monitors include:
  - PM filter, EGR, fuel system, etc.

Light-Duty Threshold Monitors

- Goal is to achieve gasoline OBD parity by 2013
  - Less stringent requirements in 2007-2009 and 2010-2012
- Necessary to allow entry of diesels into the market

LD Diesel Threshold Table

	Gasoline Threshold	Diesel Threshold Capability (multiple of FTP standard)		
Monitor	HC or NOx	HC	NOx	PM
Catalyst (3-way, oxidation, NOx SCR, or NOx Adsorber)	**1.75X**	**3-5X**	**3X**	n/a
PM filter	n/a	n/a	n/a	**5X**
All others (EGR, fuel system, etc.)	**1.5X**	**2.5-3.5X**	**2.5-3.5X**	**2.5-5X**

RED = 2007 threshold

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Catalyst (3-way, oxidation, NOx SCR, or NOx Adsorber)	1.75X	3-5X 2.5-3X	3X 2.5X	n/a
PM filter	n/a	n/a	n/a	5X 4X
All others (EGR, fuel system, etc.)	1.5X	2.5-3.5X 2-3X	2.5-3.5X 2-3X	2.5-5X 2-4X

RED = 2007 threshold YELLOW = 2010 threshold

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Monitor	HC or NOx	HC	NOx	PM
Catalyst (3-way, oxidation, NOx SCR, or NOx Adsorber)	1.75X	3-5X 2.5-3X 1.75x	3X 2.5X 1.75x	n/a
PM filter	n/a	n/a	n/a	5X 4X
All others (EGR, fuel system, etc.)	1.5X	2.5-3.5X 2-3X 1.5X	2.5-3.5X 2-3X 1.5-1.75X	2.5-5X 2-4X 1.75-2.0X

Blue = 2013 threshold

Safeguards for Interim Diesels

- Some risk of excess emissions with reduced OBD capability in interim
  - Components degrade further before detected
  - Some unproven technologies (NOx catalyst)
- Additional in-use testing proposed to minimize risk
  - Vehicles tested at low and high mileage
  - Ensure compliance with tailpipe standards
  - Recall and remedy if high in-use emissions
- Pursue including diesels in Smog Check

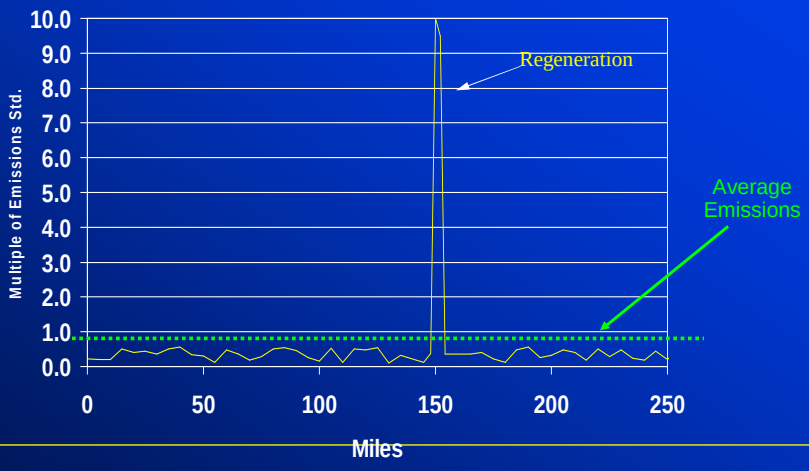
Issue: Stringency of Diesel Thresholds

- Industry:
  - Proposed thresholds not feasible
  - Workload too great
- Staff Response:
  - Thresholds feasible considering unexplored potential of latest monitoring strategies
  - 6 year phase-in of thresholds addresses workload

Background: Adjustment Factors

- Periodic Regeneration Events
  - Stored/trapped emissions purged
  - Generally infrequent
  - Performed for several diesel components (e.g., PM filter)
  - Create periods of higher emissions
- Adjustment factors account for these emissions
  - Added to normal “driving” emissions
  - Gives a true average emission level
  - Used to determine compliance (e.g., certification)

Regeneration Emissions



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Issue: Adjustment Factors

- Proposed Requirement: Calculate and use specific adjustment factors in determining OBD thresholds
- Industry Issue:
  - Use of factors increases stringency of thresholds
  - Workload too great
  - Must delay use of factors until 2010 or later
- Staff Response:
  - Necessary to ensure actual in-use emissions below malfunction thresholds
  - Interim flexibility proposed for early years
    - Use factors already calculated for tailpipe standard prior to 2010
    - Develop unique factor only for one monitor in 2008
    - Unique factors for all monitors in 2010

Background: Tracking of Emission Bypass Strategies

- Bypass strategies
  - Referred to as Emission Increasing-AECDs
  - Designed to avoid engine (or component) damage under specific conditions
  - Increase emissions when active
- Difficult for ARB to evaluate
  - necessity and frequency
  - quantify emission impact
- Need a means to validate manufacturer data

Issue: Tracking of Emission Bypass Strategies

- Requirement: Track cumulative operation with bypass strategy invoked
- Industry Issue:
  - Does not belong in OBD II regulation
  - Bypass strategies highly confidential
  - Test program of a few vehicles would yield same data
- Staff Response:
  - Confidentiality not being compromised
  - Data necessary to confirm minimal in-use activation (high emissions)

Other Items

- Conform OBD enforcement regulation to proposed changes in technical regulation
  - Recall for specific noncompliances that affect SmogCheck
- Emission Warranty regulations
  - Delete obsolete warranty parts list

Summary

- Effective OBD is essential to assuring emissions remain low
  - As important as the emission standards themselves
- Gasoline OBD working well
  - Only minor changes needed
- Diesel OBD is new
  - Time needed to develop highly effective OBD
  - Can be achieved by 2013

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Staff Recommendation

- Adopt proposed regulations with 15 day changes
- Next technology review in 2 years